Kyphotic Angles of Instrumented Thoracolumbar Junction: Impact of Thoracolumbosacral Orthosis

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Abstract

Introduction: Bracing is an accepted part of operative treatment, however, the effectiveness of bracing is controversial. We sought evidences for the effect of Thoracolumbosacral Orthosis (TLSO) on spine proximal to the fusion site in patients treated for unstable thoracolumbar junction (TLJ) burst fractures.

Materials and Methods: Fifty adult patients with unstable TLJ burst fractures are prospectively analyzed. All patients underwent posterior segmental instrumented spinal fusion. They were categorized into two groups randomly; the sample group (n=23) was recommended to wear a TLSO for eight weeks while the control (no brace) group was supposed not to use any orthosis. Fractured segmental kyphotic angle (FKA) and proximal kyphotic angle (PKA) were measured through standing lateral thoracolumbar x-rays by two independent observers twice after which mean value of four measurements was used.

Results: Pre- and post-operative PKA were 6.35 ± 3.28 and 6.70 ± 3.41 (mean ± SD) degrees respectively (P=0.35) in which no statistical significant difference was observed. The mean and standard deviation of PKA among control group and TLSO group were 6.60 ± 3.43 and 6.79 ± 3.42 respectively (P=0.18), which did not show any statistical significant difference. Among all patients the differences of early post-op (7.65 ± 4.59 degree) and one year post-op (9.18 ± 5.04 degree) FKA with pre-op (17.25 ± 10.34 degree) FKA is statistically significant (P < 0.001). No differences were found between male and female regarding both FKA and PKA in one-year follow up.

Conclusion: Based on the results of the study we found no evidence for the effectiveness of TLSO in surgically treated patients with TLJ unstable burst fractures. Treating these patients using early ambulation without TLSO eliminates the cost and patient deconditioning associated with a brace.

ABBREVIATIONS

TLJ: Thoraco Lumbar Junction; TLSO: Thoracolumbosacral Orthosis; FKA: Fractured Kyphotic Angle; PKA: Proximal Kyphotic Angle

INTRODUCTION

Burst fractures most commonly occur where the spine transitions from immobile to mobile and from kyphotic to lordotic [1]. Thoracolumbar junction (TLJ) is a transition zone including T10 to L2 susceptible to burst fractures. Burst fractures occur after the spine fails in axial compression. The fracture results in comminution of the vertebral body, disruption of one or both of the vertebral end plates, and retro pulsion of the posterior vertebral body wall (the middle column) into the spinal canal [2]. Thoracolumbar junction burst fractures can be managed based on clinical manifestation of radiographic features of fracture’s severity and neurological deficit [3]. However, the management of TLJ burst fractures still remains challenging. Unstable fractures should be treated by surgery according to neurological or mechanical instability [4]. A brace, e.g. TLSO, could be recommended for either stabilization or preventing kyphosis proximal to the fusion site. The unequivocal need for bracing as a means of spine immobilization and for prevention of kyphosis after surgery remain unresolved.
To the best of our knowledge the effects of TLSO on kyphosis proximal to the fusion site are not investigated. Current study conducted to realize whether TLSO is effective on proximal kyphotic deformity after instrumented fusion for unstable TLJ burst fractures. Objectives were considered to determine kyphotic angle after surgery in patients with and without TLSO utilization and to determine proximal junctional kyphotic deformity after instrumented fusion with wearing TLSO and without that.

**MATERIALS AND METHODS**

The prospective interventional study was conducted from 2012 to 2014 amongst patients admitted for treatment of TLJ unstable burst fractures. The study was approved by the medical school's ethics committee (K93/290). Patients were considered for inclusion if they had an acute isolated unstable TLJ burst fracture. Patients with neurological impairment, co-morbidities, multiple vertebral fractures, previous spinal surgery, and associated head injury, lower extremity injury affecting weight bearing, poor bone quality and smokers were excluded. Fifty patients ranging from 20 to 50 years old were included. All patients underwent instrumented segmental posterior spinal fusion using pedicular screws and allograft (Ceno Bone, CAT Code # D29543, Kish Free Zone, Iran). Patients were categorized into two groups randomly; the sample group (n=23) was recommended to wear a TLSO for eight weeks whereas the control (no brace) group was not advised to use any braces after surgery. TLSOs were prepared through measurement and were produced by the same orthotist. The patients were asked to use their braces the whole day. All patients were ambulated two days after the surgery with no limitations. Fractured segmental kyphotic angle (FKA) and proximal kyphotic angle (PKA) were measured through standing lateral thoracolumbar x-rays by two independent observers twice and mean values of four measurements where used. Proximal kyphotic angle was determined by measuring the angle between line drown tangential to the inferior endplate of fused upper vertebra and the line drawn tangential to the superior endplate of proximal vertebra. Radiographic measurements analyzed on preoperative, early postoperative and one year post-operation (range: 10-14 months). Data collection and statistical analysis were done using SPSS software.

**RESULTS AND DISCUSSION**

Fifty patients (14 female, 28% and 36 male, 72%) were involved in the study. Pre-operative and early post-operative FKA for all patients were 17.25 ± 10.34 and 7.65 ± 4.59 (mean ± SD) degrees respectively. The difference was significant statistically (P < 0.001). Among all patients the mean of FKA after one year follows up was 9.18 ± 5.04 degree (P < 0.001). The mean of FKA one year after surgery for control group and TLSO group were 10.78 ± 5.99 and 7.81 ± 3.75 degree respectively (P = 0.05) which revealed no statistical significant difference (Table 1).

Pre- and post-operative PKA were 6.35 ± 3.28 and 6.70 ± 3.41 (mean ± SD) degrees respectively (P=0.35) which shows no statistical significant difference. The mean and standard deviation of PKA among control group and TLSO group were 6.60 ± 3.43 and 6.79 ± 3.42 respectively (P=0.18) with no any statistical significant difference (Table 1).

**Discussion**

The results of the study demonstrate that a surgically treated unstable thoracolumbar burst fracture with a TLSO is equivalent to treating without a TLSO regarding both fractured and proximal kyphotic angles postoperatively.

The treatment of thoracolumbar burst fractures remains controversial [5-8]. Bracing is an accepted part of non-operative and operative treatment of patients with thoracolumbar fractures [9-18]. Most published papers compared various treatment strategies in terms of surgical and non-surgical or brace and non-brace utilization [19-23]. We hypothesized that a compensatory hyper mobility proximal to the surgically fused spine might be a potential risk for developing thoracic kyphosis and wearing a TLSO after surgery could be a preventive measure. The current study disapproved the hypothesis and revealed the spine proximal to the fused vertebra acts normally, at least, in one year follow up. It also showed TLSO has no effect on kyphotic angle on both fractured and proximal to the fused spine after instrumented fusion. This results are consistent with the clinical outcome measured studies [24,25].

**CONCLUSION**

Based on the results of this study no evidence was found for the effectiveness of TLSO in surgically treated both male and female patients with TLJ burst fractures. Treating these patients using early ambulation without TLSO avoids the cost and patient deconditioning associated with a brace.

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